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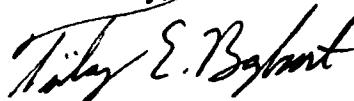
Defence Technical Information Center  
Building 5  
Cameron Station  
Alexandria, VA 22304

RE: Final Technical Report, Grant No. N00014-90-J-1208

To whom it may concern:

On May 18, 1994, Prof. Richard J. Reed received a notice that the Final Technical Report for grant no. N00014-90-J-1208 had never been received. According to our records, the Final Annual Report was equivalent to the Final Technical Report, and we sent this report as per instructions via email back on Dec. 9, 1991. Enclosed please find a copy of this report.

Yours truly,



Tülay E. Bayburt  
Fiscal Specialist

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Posted: Mon, Dec 9, 1991 7:28 PM EST  
From: R.REED.UW  
To: ONR.OAP.DIV (rec)  
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Subj: \*\* ONR P.I. Report (PO) \*\*\*

Msg: DGJB-5031-1834

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Synoptic Studies II

**Research Goals:**

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The long-term objectives of our research were twofold: (1) to gain a better understanding of the mechanism of explosive deepening of extratropical cyclones and (2) through this understanding to contribute to improved prediction of these predominantly maritime events.

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**Objectives:**

**Objectives:** Specific objectives of our near-term research were: (1) to clarify the role of surface energy fluxes in rapid marine cyclogenesis, (2) to study the evolution of the thermal structure in ocean storms and to relate it to the airflow, (3) to conduct sensitivity studies on the ERICA IOP-5 storm with the purpose of understanding why the operational forecasts for this storm were so much poorer than those for other ERICA storms.

**Approach:**

**Tasks Completed:**

**Tasks Completed:** (1) A paper describing the behavior of potential vorticity in the Scamp storm of February 1987 has been accepted for publication in *Monthly Weather Review*. (2) A paper describing the thermal structure and airflow in the Ocean Ranger storm of February 1982 has been accepted for publication in *Monthly Weather Review*. (3) The experiments on the ERICA IOP-5 storm have been completed and evaluated. A paper describing the results is in preparation.

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**Scientific Results:**

**Results:** (1) At the end of the stage of most rapid deepening a

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column of anomalously high potential vorticity (PV) was found near the center of the Scamp storm. Three components of the PV were identified: A surrogate surface PV (thermal anomaly) produced mainly by thermal advection; a low-level large PV produced in the frontal clouds by diabatic heating; and mid- to upper-level dry PV that had its origin in a tropopause depression and to a lesser extent in a tropopause fold. (2) The secluded pocket of warm air and the associated warm occlusion in the Ocean Ranger storm was shown from trajectory analysis to originate in the baroclinic zone ahead of the storm. The familiar dry slot seen in satellite imagery was caused by the intrusion of air that had sunk and dried to the rear of the upper trough. The air within the slot was rising rapidly in the vicinity of the occluded front but remained cloud-free because of the initial low humidity. (3) The rapid deepening of the ERICA IOP-5 storm was shown to result from the interaction of a northern vorticity center, sparked by the approach of a moderate upper-level vortmax, and a southern vorticity center that fed mainly on latent heat release in a mesoscale convective system. It is hypothesized that the relatively poor performance of the operational forecasts was a consequence of their inability to produce the two components with sufficient accuracy in timing and location.

#### Accomplishments:

Accomplishments: (1) Our results represent a significant advance in understanding the seclusion and occlusion processes and the nature of the dry slot. (2) Our study of the IOP-5 storm clarifies why there was such a large variation of predictability of the ERICA explosively deepening storms, ranging from 6 days in the IOP-2 storm that was controlled by the long waves to hardly a day in IOP-5 that depended on a delicate arrangement of smaller-scale features.

#### ONR-Sponsored Publications

##### References

P Kuo, Y.-H., R. J. Reed and S. Low-Nam, 1991: Effects of surface energy fluxes during the early development and rapid intensification stages of seven explosive cyclones in the western Atlantic, *Mon. Wea. Rev.*, 119, 457-476.

P Reed, R. J., and A. J. Simmons, 1991: An explosively deepening cyclone on the North Atlantic that was unaffected by concurrent surface energy fluxes, *Wea. Forecasting*, 2, 322-336.

PS Kuo, Y.-H., R. J. Reed, and S. Low-Nam, 1992: Thermal structure and airflow in a model simulation of an occluded marine cyclone, *Mon. Wea. Rev.*, 120, (in press).

PS Reed, R. J., M. T. Stoelinga and Y.-H. Kuo, 1992: A model-aided study of the origin and evolution of the anomalously high potential vorticity in the inner region of a rapidly deepening marine cyclone. (To appear in *Mon. Wea. Rev.*)

PI Reed, R. J., The ERICA IOP-5 Storm I: Analysis of

**Observational Data and Verification of Model Simulation.**

PI Reed, R. J., G. Grell and Y.-H. Kuo: The ERICA IOP-5 Storm

**II. Sensitivity Tests and Physical Interpretation.**

C Grell, G. A., R. J. Reed and Y.-H. Kuo, 1991: Numerical experiments on the ERICA IOP-5 Storm: A surprise rapid deepener.

Preprints, First International Symposium on Winter Storms, January 14-18, 1991, New Orleans, Amer. Meteor. Soc., 414-417.

C Reed, R. J., Y.-C. Tung and M. T. Stoelinga, 1991: The symmetric stability of a rapidly deepening marine cyclone as seen in a numerical simulations. Preprints, First International Symposium on Winter Storms, January 14-18, 1991, New Orleans, Amer. Meteor. Soc., 383-386.

C Kuo, Y.-H., R. J. Reed and S. Low-Nam, 1991: Thermal Structure of a Simulated Marine Cyclone. Preprint, First International Symposium on Winter Storms, January 14-18, 1991, New Orleans, La., Amer. Meteor. Soc., 372-376.

IC Reed, R. J., A. J. Simmons and Y.-H. Kuo, 1991: An assessment of the role of air-sea interaction in rapid cyclogenesis: Program and Abstracts, XX General Assembly IUGG Vienna, 11-24 August 1991, p. 143.

IC Reed, R. J., 1991: A realistic simulation of an intense oceanic cyclone and comparison of its mesoscale frontal structure and cloud features with common conceptual models. Preprint, Conference on Mesoscale Meteorology and TAMEX, December 3-6, 1991, Taipei, Taiwan.

**Statistics**

2 Papers published, refereed journals

2 Papers submitted, refereed journals

0 Books or chapters published, refereed publication

0 Books or chapters submitted, refereed publication

2 Invited presentations

3 Contributed presentations

0 Technical reports and papers, non-refereed journals

0 Undergraduate students supported

1 Graduate students supported

1 Post-docs supported

0 Other professional personnel supported

**EEO/Minority Support**

0 Female grad students

0 Minority grad students

0 Asian grad students

0 Female post-docs

0 Minority post-docs

0 Asian post-docs

**Patents and awards**

none

**Influences:**

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